

# Family Health Dataline

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- Alaska Natives have a relative risk of pediatric tuberculosis of 65 compared to Caucasians
- Census areas along the western coast have the highest incidence of pediatric tuberculosis
- 22% of pediatric tuberculosis cases were identified through school screening
- 55% of children who had at least one specimen collected had a positive culture result including 50% of those with a gastric aspirate and 48% of those with a respiratory culture
- Risk factors for tuberculosis infection following exposure to an adult with active pulmonary disease included exposure to an adult with cough, smear positivity, or a left upper lobe (LUL) chest lesion, and exposure to a parent
- Risk factors for active tuberculosis among infected children included the child's age and being an Alaska Native, exposure to an adult with a LUL chest lesion, and exposure to a parent

## Tuberculosis among children in Alaska

The Epidemiology and Evaluation Unit of the Section of Maternal, Child, and Family Health, working together with the Section of Epidemiology, performed two separate studies of tuberculosis among children less than 15 years of age in Alaska. During the first evaluation, we examined the clinical features and demographic and geographic patterns of pediatric tuberculosis while during the second evaluation we examined risk factors for acquiring tuberculosis infection and active disease among household contacts of adults with active disease. This issue of the Family Health Dataline provides a summary of these investigations.

### Methods

We examined records at the Section of Epidemiology for all children less than 15 years of age with tuberculosis during 1987-94. We combined data from these records with population figures for children under 15 years of age and demographic data provided by the Alaska Department of Labor to determine the clinical features and demographic and geographic patterns of pediatric tuberculosis.

To evaluate risk factors for tuberculosis infection and disease, we examined the records for all adults with sputum-positive tuberculosis diagnosed during 1987-94. For these adults, we examined the household contact records to determine which children exposed to an adult with active disease developed tuberculosis infection, active disease, or remained unaffected. We initially examined risk factors for infection, followed by an evaluation of risk factors for active disease among those who had become infected.

For both investigations, children were considered to have tuberculosis disease if they had a positive culture for *Mycobacterium tuberculosis* or met clinical criteria. Clinical criteria included chest roentgenographic findings (for pulmonary tuberculosis) or a symptom history (for non-pulmonary tuberculosis) compatible with tuberculosis, a completed diagnostic work-up, and treatment by a physician with two or more anti-tuberculosis drugs. For the first study, which included patients who may not have had a household exposure, clinical criteria for active disease included a Mantoux skin test reaction of at least 10 mm while during the second study, which included only patients with a house-

hold exposure, clinical criteria for active disease included a skin test reaction of at least 5 mm. During the second study, patients were considered to have tuberculosis infection (versus active disease) if they met the case definition for active disease or had a newly positive Mantoux skin test reaction of at least 5 mm.

## Results

### *Clinical Features and Demographic and Geographic Patterns of Pediatric Tuberculosis*

Seventy children with tuberculous disease were identified for an incidence rate of 5.8/100,000/year. Compared to whites, Alaska Natives (relative risk [RR], 65.0; 95% confidence interval [CI], 20.4 to 207.3) and people of other races (RR, 20.9; 95% CI, 5.6 to 78.9) had an increased risk of tuberculosis. The tuberculosis incidence rate varied between census areas from 0 to 89 per 100,000 children 0 through 14 years of age per year with census areas in the northern and western parts of the state having the highest rates (Figure 1).

The incident leading to diagnosis was known for 69 children and included a contact or outbreak investigation (57%), development of symptoms (22%), and school screening (22%). Twelve of 32 (38%) children older than 5 years, including eight of 15 children older than 10 years, were identified through school screening. Additionally, six of 10 (60%) non-Alaska Natives were identified through school screening compared to nine of 59 (15%) Alaska Natives.

Fifty-six (80%) children had pulmonary disease alone, while the remainder presented with involvement of a variety of organ systems (Figure 2).

Forty-two (60%) children had one or more cultures collected for identification of *M. tuberculosis* including four with cultures from two sites and three with cultures from three sites. Of 52 total cultures collected, 25 were positive for *M. tuberculosis* including 14 of 29 respiratory cultures, seven of 14 gastric cultures, three of five cerebrospinal fluid cultures, and one from an unknown source. Overall, 23 of 42 (55%) children with at least one specimen collected for culture had one or more positive results and four of these children had a positive smear for acid-fast bacilli. Of these 23 children, three had an infection with tuberculosis that was resistant to one or more anti-tuberculosis medications.

Figure 1. Tuberculosis rates among persons 0–14 years of age  
Alaska, 1987–94

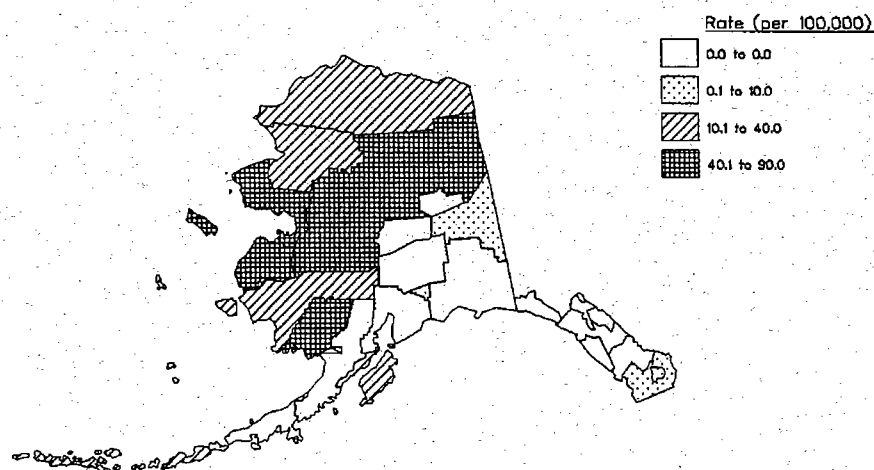
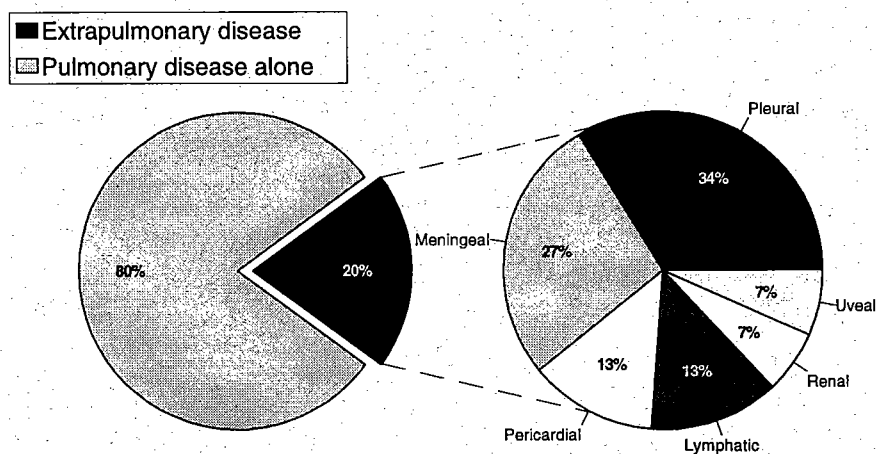


Figure 2. Clinical syndromes of 70 children with active tuberculosis; Alaska, 1987-94



## Risk Factors for Pediatric Tuberculosis Infection and Active Disease

We identified 282 children 0 through 14 years of age who lived in one of 131 households containing one or more of 142 persons 15 years of age and older with sputum-positive active tuberculosis. Of these 282 children, infection developed in 25% of children and 9.6% progressed to active disease. During multiple logistic regression analysis, the development of infection was associated with exposure to an adult with cough, smear positivity, or a left upper lobe (LUL) chest lesion, and exposure to a parent (Table 1). Among children who developed infection, progression to active disease was associated with the child's age and being an Alaska Native, exposure to an adult with a LUL chest lesion, and exposure to a parent (Table 2).

## Conclusions

During 1987-94, the tuberculosis case rate among Alaskan children 0 through 14 years of age was 5.8 per 100,000 per year. This rate is more than double the rate of 2.4 to 2.8 per 100,000 U.S. children 0 through 14 years of age per year reported from 1985 to 1994 (1) and is similar to overall U.S. incidence rates for the early 1970s (2).

The most dramatic difference in incidence rate among subpopulations occurred between different racial groups with Alaska Natives having a relative risk of 65 compared to whites. Other investigators also have noted a high rate of tuberculous disease among Alaska Native or American Indian children (2-4). These reports, however, found an incidence rate of 4.6 to 17.2 per 100,000 per year among children less than 15 years of age,

**Table 1.** Final multiple logistic regression model of risk factors for tuberculosis infection among 282 non-adult (<15 years of age) household contacts of adults (≥15 years of age) with active pulmonary tuberculosis; Alaska, 1987-94.

Risk factor	Odds ratio	95% confidence interval
Adult source with cough at time of diagnosis	2.76	1.26, 6.05
Adult source with a left upper lobe lesion	2.34	1.08, 5.06
Adult source with smear positivity	2.26	1.05, 4.88
Contact is the son or daughter of adult source	2.14	1.02, 4.48

**Table 2.** Final multiple logistic regression model of risk factors for progression to active tuberculosis among 71 infected non-adult (<15 years of age) household contacts of adults (≥15 years of age) with active pulmonary tuberculosis; Alaska, 1987-94.

Risk factor	Odds ratio	95% confidence interval
Adult source with a left upper lobe lesion	12.0	2.22, 64.8
Contact is Alaska Native	8.90	1.09, 72.7
Contact is the son or daughter of adult source	8.32	1.58, 44.0
Contact's age	1.51	1.13, 2.00

considerably less than the 23 per 100,000 per year found in the present study. We found that Alaska Natives do not have an increased risk of tuberculosis infection but do have an increased risk of progressing to active tuberculosis once infected. Factors that might explain this finding include diet (e.g., decreased vitamin D or increased omega-3 fatty acid intake) and genetic differences.

Over one half of children with tuberculosis who had at least one culture collected had a positive result regardless of whether the culture was collected from respiratory secretions, a gastric aspirate, or cerebrospinal fluid. The proportion of tested children who had a positive culture in Alaska was similar to the 46% reported for the U.S. as a whole (1) and approximately one-half of collected samples were culture-positive irrespective of the collection site. These data suggest that clinicians should collect cultures from appropriate sites, including gastric aspirates, regardless of age or symptom history.

Alaska still conducts routine school screening for tuberculosis and thus, unlike most other states, many of the cases were identified through this method. Although the Alaska Division of Public Health identified most cases through contact investigations, and this method remains the central component of public health tuberculosis control, the data from the present study suggest that school screening combined with aggressive investigation of recently infected persons may still have a place in high prevalence areas such as Alaska. In Alaska this is particularly true for school age and non-Alaska Native children.

The specific risk factors we found for pediatric tuberculosis infection and active disease should not obscure the finding that all categories of children with a household exposure to an adult with active pulmonary disease had a high risk of infection. Furthermore, specific interventions that might exploit the risk factors we found to protect high-risk groups are not

available. Thus, the most important intervention for decreasing Alaska's high pediatric tuberculosis rate continues to be the timely identification of infectious adults followed by the initiation of directly observed anti-tuberculosis therapy.

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